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Leaky Condos

From the Editor . . .

I have serious concerns about the direction that housing policy is going in this country. In part, it may be a reflection of the current conservative economic thinking that has a very short term perspective. The argument seems to go like this. Anything that is international and global is good, and anything that is local or regional is bad. Further, it is good when private enterprise is involved, but bad if there is government or public involvement.

There is much positive to be said for globalization and international trade. However, we often do not see much objective analysis of where we are going, and who is benefiting from it. There is no doubt that trade globalization is here to stay. Still, there are reasonable limits to what is appropriate, and what the impact of globalization will be on the construction industry. I have not heard much discussion about the degree to which an economy can survive on international trade, at the expense of the domestic economy. In the end, trade is a two-way street. If we export, someone else imports, so we must import also.

How does this relate to the construction industry? Currently there is a big push on the export of housing technology. Both CMHC and NRcan along with Industry Canada are devoting much effort to international trade, but cutting back on domestic research activity.

We have a lot to offer the international market. However, are we putting too much effort into the international arena? Are we forgetting that exports should only be considered the icing on the cake, and not the cake itself? We need to have a solid base of support within the country to support the needs that arise from our domestic social and economic situation and reflect climatic conditions encountered.

We may be forgetting that Canadian construction standards are the result of the long term activity of public agencies in construction research. Work done at these has always been accessible to all, and has contributed to our understanding gained over the past fifteen years, that a house-is-a-system, greater than the sum of the parts. Yet continuing or leadership position is being eroded as funds are cut back, and the public sector is edged out, primarily to support private sector export initiatives.

Lost in all the public sector devolution activity is the recognition that industry generally has a short term focus on very practical problems related to their products. Research activity remains closely guarded for their individual self interest, not for the public good. Will XYZ Corporation willingly divulge test results that show their much touted product may not perform as well as expected? Just how many resources is industry really devoting to research? Just this year, MacMillan Bloedell, which had the major private sector forest products research lab responsible for innovations such as Parallam, has been shut down in the interests of "rationalization."

The building envelope failures in the Vancouver area have generated much anxiety and concern about the source of the problem. Who is going to be left to help investigate and come up with solutions when problems arise if we shut down all public research activity? Who is going to do the pure research that contributes to our understanding of building science, and not just how well a specific component works?

Already considerable research at the National Research Council is being done with the participation of industry groups and corporations, and the findings are taking a long time to see the light of day as all funders have to approve the reports. Sometimes, a research finding may not be published at all because of "commercial privacy" reasons.

In the end, we will all be the losers as we reduce the nature and amount of research done.

Richard Kadulski
Editor

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Editor-Publisher: Richard Kadulski
Illustrations: Terry Lyster
Contributors: John Broniek, Rob Dumont, Jim Stewart, Catherine Lalonde, Tom Hamlin, Graham Turnbull, David Hill, Jim Gallagher
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Tel: 604-689-1841 Fax: 604-689-1841
e-mail: solplan@direct.ca
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"Leaky Condos" are Building Envelope Failures

A cautionary tale of what happens when the entire construction and development system breaks down.

by Richard Kadulski

Technical construction issues are not often at the top of main stream local and national media coverage, but building envelope failures in BC have recently gained that kind of profile. Mention "leaky condos" and construction horror tales emerge. Drive around Greater Vancouver, and you'll see tarp-covered buildings everywhere.

Much of the media coverage is a repetition of technical myths reported as if they were the absolute truth. We must correct the misconceptions, and also hope that members of our industry learn a lesson from the Vancouver situation. This is a cautionary tale, as problems seem to happen anywhere there's a construction boom. Only the 'details vary from place to place. Similar problems have happened in other areas, including Nova Scotia and the eastern seaboard of the USA.

Many explanations have been advanced for the current situation and a search is on for the guilty party on which to pin all the blame.

A key factor is the high level of construction activity that has encouraged unqualified participants and lowered levels of professional enforcement of existing building standards. Also, too many in our industry rely on someone else's inspections to spot incorrect application of materials and even simple quality control inspections.

The "Leaky Condo" Problem

The problem is envelope failures in new construction, mostly in the Greater Vancouver area. Water problems are happening despite the Building Code's clear and explicit regulations that buildings must not leak. These problems include water penetration, damage to cladding systems and decay of structural components. The problems are most pronounced in new low-rise (3 - 4 storey) multi-family wood frame projects, where the units are marketed as self-owned dwellings (condominiums).

The most common cladding material subject to failure is stucco, although problems have been noted with other siding products. Because of long wet periods, limited drying potential in this climate, and the construction details used, water leaks through the exterior envelope and rot sets in, leading to structural failure. Moisture eventually seeps inside the dwelling, enhancing indoor fungal growth. The poor indoor air quality will eventually create health problems for the dwelling's inhabitants.

A survey by Canada Mortgage and Housing Corporation (CMHC) found that the main source of moisture was exterior water finding its way into the walls. It is not interior moisture or construction moisture finding its way out.

Water enters at junction details: mainly at windows, the perimeter of decks, balconies and walkways, and at post locations. The cause seems to be incorrect detailing or construction of the building envelope to avoid water entry rather than poor materials or inadequate maintenance. After all, stucco has been used successfully in Vancouver for the last 90 years or more. *(Findings of the CMHC study were summarized in Solplan Review No. 72, January 1997.)*

Building Science

Three conditions must be present simultaneously for a water problem to occur in a wall:

1. there must be water on the wall,
2. there must be a hole through which the water can enter, and
3. a driving force must be acting that will move the water.

That is why the Building Code requires that the wall assembly must keep out rain water, wind, and water vapour. The assembly must also let water vapour out if it has gotten in, and keep heat in during winter and out in summer.

To control the movement of air and moisture through the building envelope, the code clearly identifies the need for an *air barrier* and a *vapour barrier*, both of which affect building performance and durability. The difference between the two is often misunderstood.

Vapour Barriers

A *vapour barrier* controls the movement of moisture through the pores of a material by slowing the rate of vapour transmission. Effective vapour barrier materials have a low permeance to water vapour. Vapour barriers must always be on

the warm side of the wall. Materials on the cold side of the vapour barrier must always be more permeable to water vapour than on the warm interior side. Vapour barriers provide protection against *interior* moisture sources.

Air Barriers

An *air barrier* stops the movement of air under pressure through the wall. It does not have to meet the vapour barrier requirements for vapour permeability. Air leakage across the building envelope is the major factor that affects envelope performance and damages the building.

Air movement in and out of the building takes place through holes and gaps in the construction. When warm air leaks out of the building, it carries moisture outward with it. Research has shown that air movement through the building envelope will move 100 times the amount of moisture that diffuses through building materials. This moisture can damage the structure as it condenses on cold surfaces.

The driving force for air movement is created by a difference in pressures. Wind creates significant pressure differences that will push or pull air through any leakage points in the envelope.

In cold weather, stack effect causes air to be drawn into the lower parts of the building, where it replaces warm air leaving through the upper portions of the building. The bigger the temperature difference between inside and outside, the more powerful the stack action to move the air. Multi-family dwellings usually have pressurized hallways that effectively pressurize each individual dwelling, creating forces that drive warm, moist air into the envelope.

The Source of the Problem

There has been much speculation about possible causes of the problem:

Building Code

The Building Code has been blamed for not being suitable for the climate. However, the intent of the code is clear. It states that buildings must not leak, and that the building be designed for the location in which it is found. The West Coast climate, although mild, is one of the most technically challenging climates for construction. Long, cool, wet periods at times with driving rain alternate with very short dry periods, reducing the length of time available for construction assemblies to dry.

The Building Code establishes a minimum set of construction standards. It is not intended to be a textbook on building design, nor does it set out quality criteria. This is an important distinction, as often there are misunderstandings about the intent of the regulations. Code provisions set out enforceable standards. Quality, being open to subjective interpretation, is not readily enforceable.

Part 9 of the code ("Housing and Small Buildings"), which applies to houses and small buildings, is prescriptive. Many multi-family projects are built under the provision of this section. Part 9 regulations offer explicit design and installation instructions for most materials and assemblies in use today. For buildings that do not fall under the scope of Part 9, the prescriptive requirements for envelope components can be still used as a guide.

Part 5 of the code ("Wind, Water and Vapour Protection"), which applies to larger structures, sets out performance objectives. The requirements are flexible and allow many alternative ways of meeting the code objectives.

Suggestions have been made that the code be modified to make the requirements more responsive to the regional climate. This implies a prescriptive code. Such a change could actually be counter productive as it will reduce the flexibility of action as new ways of assembling materials are refined.

Material Failure

The problems are happening despite the use of good materials that meet code requirements.

Exterior cladding materials must shed rain and provide a weathering surface to protect the interior parts of the wall, including the sheathing and sheathing paper. Historically, many natural exterior finish materials have been used successfully: wood siding, brick, stucco, metal. Traditionally, only a few materials have been used in any one region so designers and tradespeople learned how to use them successfully. Recently, there has been increased use of a wider range of new products such as vinyl siding and exterior insulated finish systems (EIFS - commonly called "synthetic stucco"). These new products have been developed to provide more finish options, to improve durability, to address specific market and economic needs, or for aesthetic reasons.

The BC Building Code requires that materials used for exterior cladding meet standards that apply to the product, and that these materials be installed to perform as intended. Any product applied incorrectly will cause problems. Part 9 of the code, which applies to houses and small buildings, has clear, prescriptive requirements for the design and installation of exterior claddings, vapour barriers, thermal insulation, sheathing papers, flashings and fastening devices. The requirements are readily verifiable if appropriate inspections and field reviews are carried out during construction.

Energy Conservation

Suggestions have been made that increased insulation and air sealing for energy conservation have contributed to the problem.

Using insulation to retain heat and make a home more comfortable has increased in the last fifty years. By keeping the heat in, the insulation has kept heat out of wall cavities, so the cooler temperatures may make these assemblies more prone to condensation if moisture is allowed to get into the wall. Due to lower heat flow, the materials are less able to dry out. All evidence, however, is that the source of the moisture causing problems in BC is not interior-generated or construction moisture, but exterior, weather-driven moisture.

Relying on interior heat loss to dry out water that has leaked into the building is not an appropriate solution to the problem.

Polyethylene Vapour Barriers

Many are blaming the use of polyethylene vapour barriers for trapping moisture in the walls, not allowing the walls to "breathe." The widespread use of poly was only implemented in the mid 1980s because of code changes. The vapour barrier will retard moisture migration through the wall. However, the source of the moisture causing the problems is exterior moisture that enters the envelope, and not interior moisture.

Removing the low permeance vapour barrier but maintaining an airtight envelope may work in many cases, but it still requires a very good external moisture barrier to keep the water out of the envelope in the first place.

If exterior moisture penetrating the cladding were to be allowed to dry to the interior, the walls and insulation would always be wet, and the question could well become one of why bother having any walls at all. In a wet tropical climate all you need is a good roof over your head and breezy walls, but not a cold wet climate. There is simply too much water to allow it to dry inside!

Design Issues

Some building designs are less suitable for use in a wet climate. The trend in the last fifty years to universal designs, oblivious to location and climate, is simply irresponsible. Most buildings being built today could be anywhere. Look at real estate marketing brochures and you see images of Arizona, Mexico, England, France, etc. regardless if the project is in Vancouver, Edmonton or Ottawa. A design suitable for the Arizona desert is just not right for a wet West Coast climate.

Fashion setting developers twelve years ago loudly proclaimed their inspiration was Arizona, California or Italian Mediterranean design. Today this has come back to haunt them.

Workmanship

There is much evidence that poor workmanship has also contributed to problems. The best materials, if poorly used and installed incorrectly, will not perform as intended. Trades qualifications are important, but so is adequate supervision to ensure the work has been done adequately. Both have sadly been lacking in Vancouver recently.

Greed

Boom times tend to flush out all manner of people with dollar signs in their eyes. Their less than scrupulous activities, hidden behind numbered companies, take advantage of high demand. These situations are not unique to Vancouver, as they seem to happen in all areas experiencing a construction boom.

Developer profit and marketing fees far exceed fees paid to design and technical professionals who will build the project and retain legal responsibility.

A shift in market place dynamics has changed the way projects are developed. In the past, most multi-family projects were rentals, so ownership remained with a single owner who had an interest in durability and low maintenance. Today individuals own their suite, so the developer's focus is on style and image marketing to sell units as quickly as possible, rather than long term building performance.

The Guilty Parties

Fingers are being pointed in all directions. A provincial commission of enquiry has been established with the express objective to determine who should be held accountable. The following is our analysis of the roles the various players in the industry and their part in the present situation.

Developers

Developers initiate projects. Style conscious developers may impose design visions not suitable for the climate. A bottom line with high margins is the most important consideration.

Behind numbered shell companies, created for a single project, there is no individual and no assets to go after if something does go wrong eighteen months after project completion.

Contractors

The front line people who actually put the materials together. Competitive pressures mean that a lot of work gets done on a piece-work basis and quality control suffers. Limited availability of skilled trades people in boom times does not help either. At present, there are no licensing or certification requirements for contractors in B.C., nor are there any third party warranty requirements.

Realty Marketers

Sales people may be competent to close a deal, but generally have limited technical knowledge. They stress fashion elements, ignoring technical merit, creating a situation where extra square footage of marble will be stressed rather than a more compact but better designed and built unit.

Planning Officials

Planning restrictions have encouraged inappropriate design. In some municipalities, areas under roof overhangs were counted as square footage. As a result many buildings were built with no overhangs that could offer protection to walls. Sometimes there was insistence on flat roofs to reduce others' views when pitched roofs were part of the initial design. (Sloped roofs shed water.)

In other municipalities, exterior walkways used as corridors were not counted in total square footage, leading to designs with exterior walkways - extra details that, when done incorrectly, are sources of leakage. Another zoning requirement is that exterior walls "step in" to minimize the building's impact on adjacent properties. This results in a series of flat roof areas, often used as decks for the upper floor, but which are difficult to waterproof and drain.

Architects

Architects have ultimate design responsibility. Too often they cave in to client demands or create designs inappropriate for the climate. They often do not receive the mandate to properly develop their designs. but to prepare just enough drawings to obtain the necessary permits. Full professional services, including adequate site reviews are often not performed these days.

It is a sad fact that building science is not a strong suit in architect's training. Most are more interested in Design than in careful attention to the technical details essential to execute any design. Complex, articulated designs ask for problems to happen. They work only if immaculate attention is given to detail - yet too often the appropriate detail is not provided.

The Architectural Institute of BC (AIBC) has belatedly taken a role in developing a building envelope education curriculum that will cover building science, best practice guides for rain penetration control, inspections and testing, and the professional's roles and responsibilities.

CMHC is developing a "Best Practice Manual" for building construction types found on the West Coast. This document will contain appropriate sample details, and is slated to be ready later this year.

Building Inspectors

The objective of building code regulations is to mandate basic structural and life safety. In most jurisdictions this means building envelopes are not on the inspection list. The drive to deregulate and downsize means that, as budgets are reduced, building officials often do cursory, audit inspections and rely on other professionals to certify compliance with codes and regulations.

The City of Vancouver now mandates rain screen design for some cladding types, more explicit detailing of plans at the building permit stage, and certification by a third party building envelope professional.

Financial Community

A large portion of any new development must be presold before financing is provided so that unrealistic budgets may be set and locked-in before full construction details are finalized. This increases pressures to cut corners if other costs increase as the project progresses.

Mortgage lenders and appraisers generally lack a building science background and do not give adequate weight to technical issues. Stylistic marketability concerns are given more value than construction quality.

Home Buyers

Consumers are aggrieved parties, having to cope with remedial work when things go wrong. Although it is not fair to expect them to know how a building is built, nor to know all the questions to ask, most do not do the research they do when shopping for an automobile or even household electronics. Even as the issue was gaining public awareness, many were not having independent pre-purchase inspections done, only to regret it soon after moving in.

Home owners have generally bought into the marketing hype focusing on style, finishes and the expectation of getting the extra few square feet of space, at the expense of inherent construction quality.

The Solution

There is no single guilty party. Rather it is a breakdown of the entire development process. We are aware that a house-is-a-system, the whole being greater than the sum of the individual parts. However, we seem to have forgotten that the same applies to not only to multi-family projects, but to the process as well. An implied expectation has developed that someone else is going to look at our work and will get us out of trouble if a problem emerges.

The question has been asked "What happens in Seattle, which has the same climate, similar construction practices and design approaches?" The answer may lie in a different legal structure. Americans are very litigious, so each trade tends to pay more attention to their individual jobs. Builders are liable and must guarantee their product for 4 years (water penetration is considered a structural failure). Further, the construction activity has not been as frenzied as it has been in Vancouver over the past decade and there are higher entry requirements for contractors. At the highest levels of the development management team there is an understanding that sound construction principles must be followed.

There has to be more responsibility demanded of builders and developers. This may mean tighter more powerful third party warranties, more rigorous quality assurance procedures, and contractor qualification.

There is no single guilty party. Rather it is a breakdown of the entire development process.

Taking quick, prescriptive action on a single material type will not solve the more fundamental issues in our industry. What is needed is a comprehensive approach that addresses the many issues facing all participants. More emphasis must be placed on quality assurance during construction, including inspections for conformance with current standards.

It may not be easy, but creative marketing may be needed to undo the unrealistic expectations that have been generated over the past generation. This means down playing expectations, emphasizing the importance of quality behind the surface, and explaining just why emphasis on certain design features may be wrong. ☼

Adieu, Godfather

Loyal Solplan Review readers who read everything, including the fine print copyright statements (we're surprised how many do), may have noted occasional references to the Godfather. This was our lighthearted way of referring to your editor's brother, John Kadulski, who was not only our accountant, but also business mentor. Especially in the 1970s when we started with the Solplan Series of solar energy applications books, the "Godfather's" advice and support were invaluable.

It is with sadness that we must bid adieu to the Godfather, who passed away at the beginning of May after a short illness. He will be missed.

Airtightness Construction Trends

.... mechanical ventilation is needed to avoid indoor air quality problems. Many new conventional houses have low natural air change rates..... and are tight enough to require mechanical ventilation, but most have none.

Canada is a world leader in cold climate housing. Emphasis on increasing airtightness has improved energy efficiency, reduced structural moisture damage, and improved comfort. These benefits can be achieved without causing indoor air quality problems, by paying attention to adequate ventilation, depressurization and spillage control, by improving ventilation equipment and installing depressurization tolerant combustion appliances.

National surveys of the airtightness and energy efficiency of new housing, including both conventional and R-2000 houses in all southern regions of Canada, have been done over the last 16 years. The latest tests looked at new conventional houses built in 1990 to 1996. Test results show a continued trend to more airtight houses with significant but decreasing regional differences. Houses built in the last five years are 35% tighter than those built in the previous five years.

R-2000 houses are still much tighter and more efficient than new conventional houses, but the gap is narrowing. The trend to tighter houses is strongest in British Columbia, where houses built from 1981 to 1985 were much looser than in all other regions. However,major improvements have now brought the average BC house close to the national average.

The profile of house samples was representative of the housing stock. On average, R-2000 houses are 22% larger than conventional houses. British Columbia has the largest houses by a significant margin, while the smallest houses are in Quebec and Atlantic Canada.

The significant increase in airtightness is probably due to a number of factors. Builders and house buyers are generally more aware of the issues of moisture damage, comfort, and energy efficiency, due to various programs for builder training and consumer awareness. The 1985, 1990 and 1995 editions of the National Building Code also have had some influence, although their airtightness provisions are not very significant.

The Model Nation Energy Code for Houses specifies that houses should have a normalized leakage area (NLA) of less than 2 cm^2/m^2. On average, new conventional houses in all regions are within this limit. Regions other than the Prairies and Ontario have significant numbers of houses which exceed the 2 cm2/m2 limit by significant amounts.

Greater airtightness creates a need for mechanical ventilation to avoid potential indoor air quality problems. Many of the new conventional houses have low natural air change rates, especially during Spring and Fall when windows are closed. They are tight enough to require mechanical ventilation, but most have no central mechanical ventilation systems. These houses must rely only on kitchen and bathroom fans which are seldom run continuously. Ventilation can be provided by quiet fans with automatic controls, or by heat recovery ventilators.

Greater airtightness also creates the potential for depressurization which can lead to spillage of combustion products from fuel burning equipment. This occurs when exhaust fans cause the air pressure inside the house to be lower than outside. About 35% of new conventional houses which require mechanical ventilation to prevent IAQ problems have none, and 64% have either no ventilation systems or systems that may be inadequate.

For houses with spillage-susceptible appliances, the maximum allowable house depressurization (by code) is 5 Pascals (Pa). Up to 40% of spillage-susceptible new conventional houses could have depressurization greater than 5 Pa.

The majority (64%) of all new houses have air change rates of less than 0.364 air changes (ACH) and no heat recovery ventilator (HRV). These figures range from 13% in Atlantic Canada to 83% in British Columbia. Forty-one percent of the houses have natural air change rates below 0.208 ACH and no HRVs; these figures range from 8% in the Atlantic provinces to 67% in B.C.

The conclusion to be drawn from these figures is that homes built to current practice for airtightness must have at least a central ventilation system adequately sized for the house, and suited for continuous operation.

Energy Efficiency Trends

In each region, R-2000 houses are still significantly more energy efficient than conventional houses in the same region.

New conventional houses consume an average of 93 giga-joules per year (GJ/y) for space heating, compared to 70 GJ/y for R-2000 houses.

Whether one compares new conventional and R-2000 houses, or the most and least efficient new conventional houses, the least efficient houses have poorly insulated basements that account for a proportion of total heat loss. This indicates that more attention should by given to basement insulation in new conventional houses.

R-2000 houses, on the other hand, loose more heat through windows than conventional houses do, due to their larger size and window area. The efficiency of B.C. houses is low when climate is taken into account.

Under the EnerGuide for Houses energy efficiency ratings, new conventional houses average 73 out of 100, and R-2000 houses have an average rating of 79. ☼

Airtightness and Energy Efficiency of New Conventional and R-2000 Housing in Canada, 1997
Natural Resources Canada, Building Group Department of Natural Resources/CANMET

R-2000

For information on the R-2000 Program, contact your local program office, or call 1-800-387-2000

InterBUILD '98, Calgary

How would you feel if you organized a party, and nobody showed up? The organizers of the interBUILD housing and construction show in Calgary must have felt that way. They put on an excellent trade show, and a fairly good technical conference alongside, even got the Alberta premier to open the show. Unfortunately not many visitors attended.

Trade shows have a long history of being the vehicle suppliers and purchasers use to find out about the latest developments in the industry. Industry trade shows (as opposed to consumer shows) usually have more "meat" in the content, and provide a less frenetic opportunity for exhibitors and visitors to learn about new developments and establish contacts. The biggest construction show in North America is the annual NAHB show in the USA, which is too big to visit comfortably. It was in that spirit that the interBUILD housing and construction show was put together.

I suspect that part of the poor turnout was not because everyone in Calgary is busy these days, but because the marketing implied that this was an international show for those interested in export markets, so there might be little for the local builder or trades person. Anyone not involved in export work, and this includes most of the construction industry (except product manufacturers), would have considered this not to be a show for them.

Unlike consumer goods, which can be produced in one location to serve the needs of the entire world, construction is rooted, by definition, in one place. It does not make any sense to transport houses around the globe. Perhaps some specific products, and design and management services are exportable, but not entire buildings. The bulk of construction will always be rooted locally. That is something that seems to be forgotten when so much emphasis today is placed on export trade. Too many also forget that you have to have a healthy domestic industry, for which exports are the icing on the cake, and not the cake itself.

The organizers are planning to make this an annual event, and have tentatively booked the third week of April 1999 for the next InterBUILD. We hope the exhibitors give them another chance, and that the organizers review their marketing strategy, as it could be time well spent for anyone in the construction industry. ☼

Information:
InterBUILD Expositions Inc.
Tel: 403-413-6222
Fax: 403-413-6224

Designer Grills

Forced warm air grills are a basic component of forced warn air heating systems. Standard floor grills aren't very attractive, and their aerodynamic design is nominal. To compensate for inadequate layouts and air distribution, some people have been installing deflectors to keep floors warmer and deflect air away from drapes and furniture.

A couple of Vancouver entrepreneurs have come up with a new high impact polyethylene 4 x 10 pop up vent that is available in a number of colours. A homeowner can lift the vent to get deflection of air flows, without the need to install a permanent deflector. More importantly, the grill, which can be used as regular floor register, has a very well made and easy to use damper. Air flow can be modulated very easily, and much more effectively than most metal grills. ☼

For information:
Break Thru Products Inc.
Tel: 604-552-2706
Fax: 604-534-8266

Fire Resistance of Gypsum Board Wall Assemblies

Gypsum board is an important component of fire resistant construction assemblies. When the CSA standard for gypsum board products (CAN/CSA-A82.27) was revised in 1991, the requirement for minimum density of gypsum board was removed.

The change raised concerns about the impact on the fire resistance of insulated and non-insulated gypsum board-protected wall assemblies. To find out if the new gypsum board material properties have any impact on the performance, 48 assemblies were tested by the Institute for Research in Construction at the National Research Council. Canada Mortgage and Housing Corporation and seven industry partners supported the project.

An assembly was considered to have failed if the temperature at any point on the unexposed face hit 180°C, if the average of the points rose 140°C above the room temperature (22°C), or if flame or gases hot enough to start a fire got through the wall.

One or two layers of gypsum of the assemblies tested were mounted on both sides of 2 x 4 steel studs at 24" o/c spacing or 2 x 4 wood studs at 16" o/c spacing. Non-load-bearing wood stud assemblies have a 7 to 12% better fire resistance than comparable assemblies with steel studs. Nine of the assemblies used resilient channels. Three insulation types were used: glass fibre, mineral fibre, and cellulose. The cavity insulation and its thickness was varied.

Results

Effects of Joint Orientation

Gypsum board orientation has only a minor effect on fire resistance. An assembly with a vertical joint backed by a steel stud has a slightly better fire resistance than an assembly with a horizontal joint orientation.

Effects of Resilient Channels

Resilient channels used on either the exposed side or the unexposed side have no effect on the fire resistance of the assembly. A similar result was found when resilient channels were used on both sides.

Effects of Insulation

The effects of insulation varied depending on the layers of gypsum board used on each side of the assembly and insulation type.

Glass Fibre: In most cases glass fibre insulation had no effect on the fire resistance of the assemblies compared to a non-insulated assembly. When 2 layers of 12.7 mm (½") thick Type X gypsum board were applied to both sides of the studs there was a small (8%) increase in the fire resistance. When 2 layers of 12.7 mm thick lightweight gypsum board were used on both sides, the fire resistance was actually worse than for a non-insulated cavity.

With the glass fibre insulation in the cavity, there is a quicker temperature increase in the gypsum board on the exposed side which causes premature failure/splitting of the gypsum board, exposing the cavity to direct flame earlier in the test, resulting in an earlier failure. When glass fibre is used for sound control in a fire-rated wall assembly it should be used with care. Mineral fibre insulation may be a good alternative to glass fibre as it provides better fire resistance performance.

Results of Fire Resistance Tests on Small-Scale, Insulated and Non-Insulated, Gypsum Board Protected Wall Assemblies. *National Research Council Canada, National Fire Laboratory.*

Mineral Fibre Insulation: Mineral fibre insulation improved the fire resistance compared to an uninsulated cavity, from 20% for 2 layers of 12.7 mm (½") thick regular lightweight gypsum on both sides, to 50% for 1 layer of 12.7 mm thick Type X gypsum board on both sides. In an assembly with 15.9 mm (5/8") type X gypsum board on the exposed side and 2 layers on the unexposed side, the gypsum board split prematurely. However, the mineral fibre batts remained intact in the cavity for some time, providing a fire resistance to the unexposed gypsum more or less equal to the fire resistance lost due to the early splitting of the gypsum board on the exposed side.

The thickness of mineral fibre insulation (40 mm and 90 mm) did not affect the fire resistance of an assembly with one layer Type X gypsum board exposed and 2 layers unexposed. However, the 90 mm thick mineral fibre insulation provided an 18% improvement over the 40 mm thick insulation in the assembly that had 2 layer Type X gypsum board on both sides.

Cellulose insulation: In all but one case, the cellulose insulation improved fire resistance compared to an uninsulated cavity, from 22% for 2 layers of 12.7 mm thick Type X gypsum board both sides, to 56% of one layer 12.7 mm thick type X gypsum board on the exposed face and 2 layers on the unexposed face.

In the case of the 15.9 mm thick Type X gypsum board, (one layer exposed side, 2 layers unexposed side) the fire resistance with cellulose was 17% worse than an uninsulated cavity. It was observed that, during the test, when a piece of gypsum board cracked and fell, the cellulose was completely consumed leaving no protection for the gypsum board on the unexposed side.

The dry blown cellulose fibre provided a 41% better fire resistance than the assembly with wet spray.

The tests show that the mass of the gypsum board does have an effect on the fire resistance of the assemblies. A reduction in density of 7.82 kg/m² to 7.35 kg/m² for a double layer gypsum board assembly provides a 21% poorer fire resistance. Because the requirement for mass per unit area has been removed from the CAN/CSA-A82.27 standard, designers may have to specify more than just the thickness of gypsum board for fire-rated assemblies. ☼

Lifebreath Clean Air Furnace

Nutech Energy Systems has unveiled a new integrated heating and ventilation system. It uses a fan coil heating unit to take heat off the water heater for a forced warm air heating system. Its unique feature is the integration of a heat recovery module. The fan maintains continuous air circulation, so there is a continuous air exchange through the unit. The ventilation air flows are constant - typically 50 - 70 cfm at low speed, and 100 - 140 cfm at high speed.

The unit is available in two sizes: 40,000 and 60,000 Btu.

Because the ventilation air is exhausted from and supplied to the furnace return air stream, this ventilation strategy only address whole house air exchange. It does not address ventilation effectiveness. You still need to have separate exhaust fans in the bathrooms to deal with moisture and odours.

In our view, this does not appear to be a good approach for new home construction. However, the manufacturer is targeting this equipment for the furnace replacement and retrofit market, where this unit offers air exchange along with the heating functions for existing homes. ☼

Information
Nutech Energy Systems Inc.
Tel 519-457-1904
Fax 519-457-1676

e-mail:
nutech@lifebreath.com
http://www.lifebreath.com

Non-toxic Wood Treatment?

Some wood applications require preservative treatments to maintain a long useful life. All treatments used to date require the use of toxic chemicals. The toxicity of some may be low when they are fixed in the wood when in use, but working with and disposal of treated wood can be a problem.

Is there such a thing as a non-toxic preservative treatment? According to wood biologists, the simple answer is no. We are planning in the future to do a review of wood treatment options. However, we recently discovered a product on the market that claims to be an all-natural, non-toxic wood treatment.

The ***LifeTime Wood Treatment*** does not claim to be a preservative, but a treatment made of completely natural products, using a recipe that, the manufacturers claim, has been in use in Scandinavia for more than 60 years. It is not expensive (concentrate for 1 gallon is about $15.), and is sold in powder form, which is mixed with water for application to raw wood. The manufacturer said that like Coca-Cola, they cannot divulge the secret ingredients in the formula.

Parks Canada has been using the product for signage and park furniture (including fence posts), as has the BC Ministry of Transportation and the City of Calgary.

Is this the magic solution to non-toxic wood preservative treatments? The jury is still out on this one. The protection offered may be suitable to extend wood life in the dry climate of Calgary and the Rocky Mountain National Parks. But what about severe wet climates? I have undertaken an informal test program in North Vancouver. I have used the *LifeTime Wood Treatment* on wood boards used for raised garden beds. Alongside these treated boards, I have buried both treated and untreated pieces. Next spring, after 12 months, we will see what shape the treated and untreated wood pieces are in.

At this time, this is not the product for use where pressure treatment is required for structural use (it would not meet codes, and may need more third party testing). However, for other uses, including landscaping, fencing and decks, this may be an alternative. ☼

For information:
Valhalla Wood Preservatives Ltd.
1931 - 12 th Ave. SW
Calgary, AB T3C 0R9
Tel: 403-228-5193
Fax 403-229-9365

Technical Research Committee News

Canadian Home Builders' Association

Building Code Review Task Force

The code development process in Canada is presently being reviewed. The task force recommendations may result in fundamental changes to the Canadian code development process. The hope is to establish a streamlined, more coordinated code development system to bring greater uniformity and less overlap in building regulations. Some provinces, especially BC and Ontario, have always made significant changes which made their code deviate from the National Building Code.

Regulatory authorities must be confident that the code development system meets their needs with respect to technical soundness, accountability, economic impact analysis, stakeholder buy-in and decisionmaking. A complete and user friendly tracking and information system, using the Internet for example, would enhance openness and make sure that all stakeholders are involved and aware of the status of code development.

The task force seems to be going to a process where the point of entry of code change proposals will be made to the provinces. A technical review may (or may not) be done at the provincial level before the proposals go the National Research Council Codes Centre for detailed technical analysis and public review. The national process could deal only with agreed-upon "core codes," which should rarely require change by their adopting authorities. However, there would be provision for adopting authorities to make changes and additions.

Several "straw models" have been developed that attempt to account for issues raised in presentations and discussions. Three are posted on the Canadian Codes Centre web site.

http://www.ccbfc.org/ccbfc/tgs/review/index_E.shtml

EnviroHome

The EnviroHome is a display project that offers an opportunity to show how energy efficiency and environmentally responsible technologies can be incorporated into mainstream home designs. The minimum requirements for each home is that it be a registered R-2000 home, and also include all R-2000 environmental options. Four EnviroHome projects are currently under way.

In April, Linconberg Homes in Calgary opened their show home in the Hanson Ranch subdivision in the north west portion of the city.

On June 26, Penzer Construction will open their EnviroHome in Langley. Construction progress has been documented on their web site:

(*http://www.penzer.com*).

Other projects are currently underway in Fredericton, NB and the Annapolis Valley of Nova Scotia.

Any builder wishing find out more about EnviroHome, or to take advantage of this opportunity should contact John Broniek at the TRC.

Roof Trusses: Limit State Design

We usually do not give much thought to how a roof truss has been designed. We want a truss for the job it does - provide a structure to span large spaces.

Up to now, truss design has been based on working stresses. Because of code and standards changes, the approach has shifted to the use of limit state design (procedures published by the Truss Plate Institute of Canada). These changes mean that wood structures are now designed using the same methods used for steel and concrete. This may seem a bit obscure, especially as all manufacturers rely on computer software for the truss design.

The new design procedures take into account changes in load requirements that had not been before. The net effect seems to be recognition of the improved performance of the top chord. It means that what was a 2x6 top chord may in some cases now be a 2x5. The bottom chord, on the other hand, may increase in size due to deflection limitations.

At this time, the new design procedures are being phased in, as new standards are being adopted in different parts of the country. There will be a learning curve ss truss manufacturers switch to new design software. In reality, this is a change in technical administrative details, and there should be no price increases. However, in some areas of the country, builders are being told that the change to the design procedures will mean a price increase - some builders being told the increase may be as much as 25%.

CHBA as well as the Canadian Wood Council and Wood Truss Association are monitoring this situation, and would like to hear of any cases where there may be significant changes in truss design or prices. If you have experienced any significant changes, ask the truss manufacturer to provide you with a comparative printout of the truss layout - for working stress and limit state design, and send a copy to CHBA. This will help analyze the implications of the change.

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector.
Canadian Home Builders' Association,
Suite 500, 150 Laurier Ave. West, Ottawa, Ont. K1P 5J4
Tel: (613) 230-3060
Fax: (613) 232-8214
e-mail:
chba@chba.ca
http://www.chba.ca

Building Codes and Builder Responsibility

The National Building Code is undergoing a fundamental review, going back to the root objectives of code requirements. The 2001 edition will be an objective based document. In BC, there has been a lot of discussion about the responsibilities of builders and other participants in the construction/development sector.

As a society, we have evolved a rather elaborate corporate web whereby too many people can hide behind the shields of a numbered company, thus avoiding taking responsibility for their actions.

We thought it would be interesting to reproduce a segment of the earliest known building laws, written 4000 years ago. They are a part of the Code of Hammurabi. How many of us could sleep soundly, knowing we had to comply with these requirements? ☼

- *If a builder builds a house for a man and completes it, that man shall pay him two shekels of silver per sar (about 12 square feet) of the house as his wage.*
- *If a builder has built a house for a man and his work is not strong, and if the house he has built falls in and kills the homeowner, the builder shall be slain.*
- *If the child of the householder is killed, the child of that builder shall be slain.*
- *If the slave of the householder be killed, he shall give slave for slave to the householder.*
- *If goods have been destroyed, he shall replace all that has been destroyed; and because the house that he built was not made strong, and it has fallen in, he shall restore the fallen house out of his own material.*
- *If a builder has built a house for a man, and his work is not done properly and a wall shifts, then that builder shall make that wall good with his own silver.*

Letter to the Editor

You were "amazed" (letters, Solplan Review March 1998) to hear that many houses rely on electric-powered sump pumps to keep basements dry. This situation is probably a lot more common than most people realize.

Here in southern Ontario, where full basements are the norm, sump pumps were a necessity in the past because storm sewer connections were not available. Today there are still many areas without storm sewers, as well as basements that are too low to connect to the ones available.

As a result, power failures often mean flooded basements, and that seems to be an accepted fact of life for many people. However, because we have a very reliable hydro system, there are relatively few times when the power is off long enough to cause overflowing sumps.

The only reason to install a sump pump is that the weeping tile drainage system cannot drain by gravity to ditch or storm sewer. "Bad run-off design and high water tables", however unfortunate, have nothing to do with it, because drainage is the key to keeping a basement dry!

As a leakproofing consultant, I always try to convince my clients to avoid using a sump pump wherever possible, even when the alternative involves considerable extra cost. However, sometimes that's not possible. In those cases, extra-large storage capacity must be built into the sump to keep the basement from flooding during a power failure. This usually means a large sump that's more like a cistern, or else dropping the floor of the service room where the pump is, to form a reservoir.

Congratulations on your excellent newsletter. It's about the only place I know where up-to-date practical building science information is widely available. You're providing a valuable service. Keep up the good work!

Joe Sartor
Contec Building Science
Islington, ON

Unvented Gas Fireplaces

Graham Turnbull

Unvented gas fireplaces are not authorized for use in Canada, although there is a big move to their use in the U.S.A., where about 40% of gas fireplaces sold are unvented. Customers will find out about these fireplacesand ask to have them installed. Unvented fireplaces should continue to be unacceptable in Canada.

Unvented units come in all styles from logsets and packaged fireplaces, to free standing heaters and stoves. One of the scariest recommendations made in sales literature is to permanently close the damper of a regular masonry fireplace and install a logset unit, including a sandpan logset which probably burns dirtier than any other fireplace burner. The main argument given in favour of a vent-free unit is that, because there is no vent, 100% of the heat produced goes into the home.

The maximum size of a vent-free fireplace unit is 40,000 Btu/hr, with the average being around 30,000 Btu/hr.

As the name describes, there is no venting system connected to the fireplace to take the combustion products outdoors. The burners used are the same as in normal vented units, and the combustion produces the same combustion products. The same volumes of carbon dioxide and water vapour are produced, but are discharged in to the living area of the home. Carbon dioxide can cause nausea, headaches, etc., and vapour can condense on cold surfaces and cause building problems. Nothing has been done to the combustion process to change or clean it up to allow these units to be unvented.

The US Vent-Free Gas Products Manufacturers have developed sizing requirements intended to ensure a safe and acceptable air quality for homes in the different climate zones of North America. The guidelines take into account "loose", "average" and "tight" construction. Using the sizing information in a 25 ft. x 15 ft. living room of an average home in the Vancouver area, the maximum fireplace size would be 7,350 Btu/hr, while the same home in Calgary would be 9,5000 Btu/hr. At these sizes, the impact on indoor air quality might be acceptable due to the small volumes of combustion gases produced. However, there are few (if any) units this small. Would a customer be satisfied with this amount of heat?

Fireplace standards do allow limited amounts of carbon monoxide (CO) to be produced. Poorly maintained units could produce even more CO, which is also discharged into the home. Fireplaces generally have dirtier combustion than other gas appliances as a yellow (dirty) flame is used to simulate solid fuel combustion. For years and years it has been drummed into us that gas appliances require a vent (and rightly so), and the design of these unvented units has done nothing to change this requirement.

The oxygen depletion sensors required on these unvented units do not detect CO. They will only shut down the unit when the oxygen content in air drops to 18% from the normal 21%. A drop in oxygen ratio does not always occur when CO is being produced. CO is lighter than air and rises in a room. The oxygen sensor is at the pilot level, which is usually near the floor, so the potential for unsafe condition is present with or without the sensor.

In B.C. only one type of unvented heater was and is accepted. It is an infrared unit that has very clean combustion, limited to a maximum of 20,000 btu/hr, cannot be the only heating source, and must have an air supply. Unvented fireplaces have not become as popular as expected, because of complaints of smell, condensation and paint discolouring. The combustion in these infrared units is much cleaner than that of the typical burner system used in gas fireplaces.

Regulatory authorities in Canada have not accepted unvented fireplaces at this time and should be encouraged to maintain this position. It makes a lot of sense not to allow these unvented units because there are so many choices in price, style and venting systems, without risking safety for the few dollars saved by not installing a vented system. ☼

Graham Turnbull is retired from the B.C. Gas Safety Branch, where for many years he was responsible for the BC Gas Code.

Sick School Buildings Video

We do not normally do video reviews, especially three year old videos. However, this is still a current video that may be of benefit to some readers. **Environmentally Sick Schools** is a 90 minute tape that shows the how, why, when, where and what causes school-building related illness, behaviour and learning problems.

The principal behind the video, Dr. Doris Rapp, is a physician who specialises in environmental medicine and pediatric allergies. The material is credibly presented without hype.

The video shows the reactions children (and adults) can have when exposed to materials that otherwise seem normal in our environments. While it focuses on the problems encountered in school buildings, they are universal and can just as easily be encountered in the home or workplace. The healthy house program of CMHC is meant to deal with some of these problems so that home environments do not get worse.

If you need a dramatic illustration of what a sick building is and can do to people, this video will show you. If your kids are having problems at school, this might offer one explanation.

Information:
Practical Allergy Research Foundation
P.O. Box 60, Buffalo, NY 14223
Tel. 1-800-787-8790

Noise Reduction Through Windows

Windows have received much attention in recent years for the innovations in the energy performance of glass. Windows also have an acoustic impact on the interior, as they can allow a lot of noise to enter a building. As we build more compact communities, the acoustic properties of windows take on more importance.

Selecting windows for buildings located in noisy environments must be done carefully. Designers should not rely only on the composition of glazing to determine the sound isolation capability of operable windows. Factory sealed double glazing can have lower sound transmission loss than published data for glazing of apparently identical composition.

Current acoustical data for windows is based only on the glass component, and not on the whole assembly, including the window's frame. Data on sound transmission loss on fully operable windows is not easily available.

Recent testing of a number of window types found a wide range of Sound Transmission Class (STC) ratings. Fixed double glazing alone varied from STC 25 to STC 34. For energy performance, the optimum air spacing is ½ to 5/8". However, double glazing with a wider airspace provides a higher STC rating. The STC measurements for casement, horizontal sliding, and double hung sash varied from STC 27 to STC 41. In general, the STC rating of casement windows was about 3 points higher than the rating measured on the same sized stand-alone glass with the same glazing composition, which was sealed in the opening tested. The type of spacer materials, whether metal or insulating, does not have an impact on acoustic performance.

Unbalanced construction (one 3 mm and one 6 mm glass), gives better sound isolation at high frequencies. The STC rating increases by approximately 6 points.

Aluminum, wood, and PVC casement windows with identical glazing have similar sound isolation performance. The STC ratings varied by 2 points. STC 37 is the maximum rating which could be obtained from an operable casement window equipped with a 25 mm (1") thick thermopane.

The sound isolation efficiency of the gaskets at the perimeter of operable window sashes seems to vary substantially with the type of window.

A degradation of about 3 STC rating points could exist between the acoustical performance of an openable casement window and the published data for a sealed window with the same glass composition. ☼

MJM Acoustical Consultants Inc. For CMHC

Energy Answers

Rob Dumont

What is it like to live in what may be the world's best-insulated house?

Let's break that question down into a few parts.

First, how well insulated is your house?

There is lots of insulation: the attic is R80 (RSI 14), the walls are R60, the basement walls are R60, and the basement floor is R35. It is possibly the best-insulated house in the world. We used cellulose insulation throughout, because of its carbon-fixing nature (wood pulls carbon dioxide out of the atmosphere) and because of its recycled content.

What are the other energy-efficient factors that cause the house to perform so well?

Besides the high insulation, we have excellent windows. They are triple-glazed with two low-E coatings, argon gas, and low-conductivity spacer bars. The house is very well sealed. It has a tightness level of 0.47 air changes per hour at 50 pascals. To my knowledge this is the third tightest house in Saskatchewan. In addition, we have 170 square feet of solar panels on the south wall of the house.

So, it is not just the insulation that makes the house an efficient performer. The airtight envelope, excellent windows, high-efficiency double-core air-to-air heat exchanger, passive and active solar systems, low-energy appliances, compact fluorescent and T8 lighting have contributed as well to the good performance.

What are some observations about the comfort in the house?

One thing we have noticed is that putting the heating source underneath the windows in the house is not necessary, although temperatures here in Saskatoon will drop to -40°C, and our average temperature in January is about -18°C. The windows are quite good insulators, and consequently, the cold window effect is not noticed in the house. Thus one of the first observations is that even in a very cold climate, it is not necessary to put space heating under every window in every room. This has many implications about where forced air outlets can be located. One could save a modest amount of money on a house by having the warm air outlets along the interior partitions, rather than along the outside walls.

A second observation is that although there is a very good insulation factor through the house, we need a space heating source in every room with a door. We have noticed that if the heat is turned off in a room and the door is closed, less convection of heat occurs. In colder weather, the room temperature will drop a couple of degrees Celsius, and the room will be outside the comfort zone. However, if you do have a very open floor plan, and there are no doors, it is not necessary to have a heat source in each room in a very well insulated and sealed house. Again, this has implications for reducing the cost of heating systems.

In your low-energy house, do you notice the cold outdoors as much as in a conventional house?

I once lived in a house that was extremely leaky. It had been partially rebuilt, and the house had an air change rate of 33 air changes per hour at 50 pascals. Needless to say, it was breezy, and one thing that I noticed was that the house temperature had to be raised in the colder weather because it was so uncomfortable, particularly when sitting near the windows, because of the radiant effect of the cool window surfaces. The draftiness and uneven temperatures of the house were also noticeable.

So, definitely, when you have a very well-insulated house and sealed house with good windows, even in a very cold climate, the house interior conditions become much less dependent on exterior conditions.

How do you handle humidity in a cold climate house?

In colder weather, the moisture content in the air outside drops considerably, and the fresh air being brought in through the air-to-air heat exchanger is very dry. We ventilate the house at approximately 50 litres per second (100 cfm). The house has a floor area of 3,300 square feet, and my wife, daughter and I live in the house. This ventilation rate is about 0.23 air changes an hour, and is sufficient to control odours, building material offgassing, etc. What we find is that if we do not humidify, the humidity level in the house will drop below 20% relative humidity in colder weather, and the Canadian residential guideline is 30%. Thus we use a humidifier at night, on the second floor where the bedrooms are located, and can maintain relative humidity levels at about 30% through the winter. The humidifier is a Duracraft model which is quiet and has a wick type of humidification pad, with air blown through the pad. This humidifier has the advantage that none of the salts in the water are released into the air, and therefore, the air quality is not compromised. Because of concerns about bacterial growth, every morning we run the humidifier dry and in the evening fill it with fresh water. It is a real challenge in larger homes in cold climates that are properly ventilated to get sufficient humidity without adding pathogens to the air from poorly designed humidification apparatus. Although there is a little labour associated with the humidifier, it is satisfactory for us.

What implications do you think the use of so much insulation has in a house?

One implication is that you can save quite a bit on the mechanical systems in a house by going to much better insulated walls, attics and floors. This house has 3,300 square feet including the basement, and the peak heat loss is only 4.5 kW, or 15,400 Btu per hour. With this small heat loss, it is possible to use smaller heating equipment with a resulting saving in cost.

A recurring theme of mine is that houses are not just grab-bags of unrelated components, but should be a "system" where items are carefully sized and integrated. I would ask people to look carefully when they are designing houses and reap the benefits of properly sizing such things as heating equipment.

One of the things that I have noticed is that the price of insulation has stayed relatively constant over the last 15 years. Most of the batt and cellulose insulation has stayed around 2¢ per square foot per R value over this period, whereas many other components in houses like furnaces and wood, and so on, have increased in price. This is important, because some old rules of thumb about what is an appropriate amount of insulation in a house have not taken into account the fact that the price of insulation has stayed relatively constant while other items have inflated.

What is the energy performance of your house?

Conventional houses in Saskatoon generally run somewhere between 250 and 300 kWh per square metre of floor area per year. The R-2000 houses on the prairies measured some years ago came in at 143 kWh per square metre, and for this last year which, admittedly, has been very warm by our standards, we have only used 38 kWh per square metre. The previous winter it used 47 kWh per square metre. Thus, the house uses about one third the energy of the R-2000 houses, and about one-sixth the energy of a conventional house of the same size.

What other things do you want to do to your house — do you plan to improve other aspects of the house?

Well, to start with, I don't plan to retrofit the walls in the near future. However, there are several appliances that we would like to upgrade. Our washing machine is a conventional top-loading unit and we hope to replace that with a horizontal axis washing machine which will reduce hot water consumption. We have the plumbing in the house set up so that a grey water heat exchanger can be added, and we would like to do that. We would also like to replace the old freezer in the house which is an R12 Freon-based unit with a newer R134A unit. A similar-sized new freezer uses about one-half the energy of our existing freezer. So these should help to bring our energy consumption down further.

Any final comments you would like to make about the house?

Yes. As concern about the deterioration of the atmosphere caused by fossil fuel burning increases, I think more people will have to start building houses to the same level of efficiency as our house. I also hope that in a few years our house will be regarded as thermally obsolete as better, more-efficient technologies come along.

Meanwhile, if all Canadian buildings were constructed or retrofitted to the standards used in our house, Canada would be a long way toward meeting the Kyoto targets.

NRC·CNRC Technology Insights from IRC

A regular feature reporting on construction technology developments at the National Research Council's Institute for Research in Construction

By Jim Gallagher

This article launches a regular one-page column from the Institute for Research in Construction (IRC). Our purpose is to present to you, on a regular basis, key results and practical insights from the research and technology activities underway at IRC. We believe that effective dissemination of practical information to the construction industry is essential if the industry is to continue to advance technically and achieve the quality demanded in this competitive age.

In this undertaking, we are pleased to be working with Richard Kadulski, a practical, common-sense individual who is a long-time champion of research and quality construction. Richard shares our views on technology transfer and has worked hard to make Solplan Review the respected and influential publication it is today.

IRC Focussed on Industry Needs

Our partnership with Solplan Review is a natural one, for IRC too is a leader, with over 50 years of experience in construction research. Today, we continue to make significant advances by focussing on the important technical issues facing the industry. Our research is organized under the following programs:

The Building Envelope and Structure
The Indoor Environment
Fire-Risk Management
Urban Infrastructure Rehabilitation

The **Building Envelope and Structure** Program emphasizes the development of technologies for the proper design of the building envelope to effectively control the transfer of heat, air and moisture through the walls, windows and roof. Also addressed are structural elements important to the safety and durability of the building.

Given the demand for a productive workforce in our knowledge-based economy, IRC's **Indoor Environment** Program is developing knowledge, tools and techniques that enhance the design and operation of indoor environments from the standpoint of four key elements: lighting, ventilation and air quality, thermal comfort, and acoustics.

Our researchers seek to understand how these elements affect occupant comfort and satisfaction, which, in turn, have a major influence on performance and productivity in the workplace. This is done in an indoor environment research laboratory and a materials emssions chamber.

Comfort and satisfaction are one thing. Safety is another. Because the loss of life and property caused by fire and the cost of fire protection are high, IRC's **Fire Risk Management** Program has focused on reducing these costs and losses through research on advanced risk management tools and cost-effective fire protection technologies. The research is divided into four categories: active fire protection (fire suppression, detection, smoke management); fire-resistant construction (emphasizing innovative passive protection systems); fire safety in multi-storey buildings (including occupant evacuation); and fire safety in light industrial buildings.

The **Urban Infrastructure Rehabilitation** Program is working on numerous projects concerned with the rehabilitation of aging and deteriorating urban roads (whose conditions differ from those of open highways), buried services such as water lines and sewers, and bridges and similar structures. Recognizing that many proven technologies are not being used, IRC has been working for several years to build support for the creation of a national technical guide for municipal infrastructure.

On a related front, IRC has established an evaluation service to speed up the introduction of innovative infrastructure technologies. This service is offered by IRC's evaluation arm, the Canadian Construction Materials Centre (CCMC).

Code-Development Support

Since its establishment IRC has played a leadership role in helping industry develop the National Building Code and other national codes such as the National Fire Code, and more recently the new model energy codes. This work continues, as IRC collaborates with the code-writing committees. A new challenge is the move toward objective-based codes.

Publications and Seminars

Technology diffusion at IRC is accomplished through publications, seminars, magazine articles and, increasingly, the Internet. In 1997, we introduced a new publication series called Construction Technology Updates, available by subscription. Our publications catalogue and some publications are now available in full text on our web site, free of charge.

Information:
http://www.nrc.ca/irc
tel: 1-800-672-7990

National Research Council Canada | Conseil national de recherches Canada

Coming Events

Mechanical Ventilation Requirements for Houses Seminar organized by the NRC Institute for Research in Construction
for builders and building officials
Calgary June 22, 1998
Fredericton June 24, 1998
Edmonton June 24, 1998
Halifax June 26, 1998
Saskatoon June 26, 1998
Tel 613-993-0435
Fax: 613-952-7673

August 23-28, 1998
ACEEE Summer Study on Energy Efficiency in Buildings
Pacific Grove, CA
Tel: 202-429-8873
Fax: 202-429-2248
http://aceee.org

August 22-23, 1998
EarthFEST, Courtenay, BC
A fun event to bring people together and provide them with enthusiasm, ideas and tools to live more sustainably on the planet.
Themes & technologies & methods to be demonstrated F = Food E = Energy S = Shelter T = Transportation + Water
Tel: 250- 537-2616
Fax: 250- 537-2681
e-mail: earthfest@saltspring.com

October 16-17, 1998
NEX '98 North American plumbing, heating & cooling trade show
Toronto, ON
Tel: 416-695-0447
Fax: 416-695-0450
e-mail: ciph@ican.net

October 26-28, 1998
Green Building Challenge '98
Vancouver, BC
Tel: 613-943-2259
Fax: 613-996-9909
http://greenbuilding.ca

October 28-31, 1998
Excellence in Building Conference
1998 EEBA conference
Washington, DC
Tel: 612-851-9940
Fax: 612-851-9507
http://www.eeba.org

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